



How community gardens may contribute to community resilience following an earthquake

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ABSTRACT

The paper examines community benefits provided by an established community garden following a major earthquake and discusses possible implications for community garden planning and design in disaster-prone cities. Recent studies show that following extreme storm events community gardens can supply food, enhance social empowerment, provide safe gathering spots, and restorative practices, to remind people of normality. However, the beneficial role played by community gardens following earthquakes is less well known. To fill this gap, the study examines the role played by a community garden in Christchurch, New Zealand, following the 2010/2011 Canterbury Earthquakes. The garden's role is evaluated based on a questionnaire-based survey and in-depth interviews with gardeners, as well as on data regarding the garden use before and after the earthquakes. Findings indicate the garden helped gardeners cope with the post-quake situation. The garden served as an important place to de-stress, share experiences, and gain community support. Garden features that reportedly supported disaster recovery include facilities that encourage social interaction and bonding such as central meeting and lunch places and communal working areas.

1. Introduction

In times of crisis, gardens play an important role in community resilience. They have been central to community recovery (Camps-Calvet et al., 2015; Fox-Kämper, 2016, 365). Historically, community and allotment gardens have supported their communities following political and economic disturbances. Allotment gardens emerged in response to food shortages during the industrial revolution (Barthel et al., 2015). And, in the twentieth century, considerable amounts of food were produced in backyards, allotments and community gardens during the two World Wars (Barthel and Isendahl, 2013, 231; Crawford et al., 1954). After World War II, community gardens were established in response to environmental and economic concerns including food safety and rising food prices (Firth et al., 2011), and to political disturbances, such as the 1973 oil crisis (Keshavarz and Bell, 2016, 25) or following the collapse of the Soviet Union (Altieri et al., 1999). Studies indicate that community gardens also play a crucial role in providing support systems in socially deprived neighbourhoods (e.g. Kingsley and Townsend, 2006).

Community gardens also play key roles in support of community recovery following extreme environmental events such as floods and storms. Sims-Muhammad (2012) demonstrated their role in minimizing

food insecurity before and after hurricanes in Southern Louisiana. During and after Hurricane Sandy in New York City, community gardens were perceived as safe spaces and “multi-purpose community refuges” (Chan et al., 2015, 625). Okvat and Zautra (2014) argued that community gardens may bolster “psychosocial resilience after a disaster” (85) by providing post-trauma therapy for users that help “alleviate negative emotions and [...] engage in experiences that enhance positive emotions” (81). Following Hurricane Katrina in New Orleans, Kato et al. (2014) observed that community gardens helped empower communities in deprived urban areas to participate in the political discourse that drives disaster recovery and to counteract socio-economic injustice. Community gardens encourage social interaction and cohesion, they help build networks and relationships between people and provide multiple opportunities for collaborative action (Firth et al., 2011, 565) – all crucial factors for social capital construction and community resilience following a disaster (Aldrich, 2012). Disaster resilience depends on “the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures” (UN/ISDR, 2004). Community gardens help prepare cities for times of crisis by increasing “the resilience of urban social-ecological systems” (Barthel and Isendahl, 2013; see also Barthel et al., 2015;

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Bendt et al., 2013; Chan et al., 2015, 632; Colding and Barthel, 2013). However, each disaster has different effects on communities. Therefore, there is a need to analyse the role of these gardens in the wake of a variety of disasters.

When the first European settlers arrived in New Zealand in the 1840s, they found that the indigenous Māori population had a tradition of communal gardening which started to decline in the late nineteenth century (Earle, 2011). Across New Zealand, residential subdivision designs were historically defined by quarter-acre lots that provided sufficient space to grow fruits and vegetables within individual gardens (Trotman and Spinola, 1994, 16); “[g]rowing your own vegetables wasn’t just encouraged – it was little short of a moral obligation” (Dawson, 2010, 232). However, the popularity of backyard food production began to decline in the 1960s in response to socio-economic and lifestyle changes (Walker, 1995, 154).

Since the 1970s, community gardens have become more popular and the number of urban community gardens has increased in New Zealand. Trotman and Spinola (1994) argue that growing urban populations, increased subdivision densities, growing needs to strengthen community networks, and a general revival of urban food production are popular reasons for people to join community gardens (Trotman and Spinola, 1994, 16). Official statistics about the number and geographical distribution of urban community gardens in New Zealand do not exist. Based on our own 2016 web-based review of New Zealand city councils’ and gardening organisations’ websites, there were approximately 150 community gardens within New Zealand’s three largest cities (Auckland, Wellington, Christchurch). Community gardens in New Zealand provide social and health benefits “paralleled those described in the overseas literature” (Earle, 2011, 150). However, community garden research in New Zealand has remained fairly invisible to the global research community (Guitart et al., 2012).

Christchurch is historically known as the “garden city” which is not related to Ebenezer Howard, 1902 urban planning vision but due to the city’s abundance of public parks and private gardens. The city features predominantly low suburban residential densities (CCC, 2013) which allow for growing food in many private backyards. However, there are around 30 community gardens in and around Christchurch (CCGA, 2016) and while the international literature, particular from the United States, has often focused on benefits of community gardens in socially deprived areas (Guitart et al., 2012), Christchurch’s community gardens are located across the city in both affluent and less affluent areas. The popularity of communal gardening in Christchurch is likely owed to its beneficial social functions in the sense of providing open ‘third places’ (Jeffres et al., 2009; Oldenburg, 1989) that bring people together – often from different socio-economic, ethnic or cultural backgrounds – to enjoy gardening and other social activities. With the recent global revival and promotion of urban food production, community gardens in New Zealand and Christchurch may also be seen through an urban resilience lens. Christchurch City Council (CCC) supports community gardens through a “Food Resilience Policy” (CCC, 2014). The council established community garden guidelines based to “encourage community gardens throughout the city” based on a vision “for Christchurch to become the ‘best edible garden city in the world’” (CCC, 2016, 1).

This paper evaluates the role of a community garden in Christchurch, New Zealand in the aftermath of the 2010/11 Canterbury Earthquakes. The most destructive earthquake occurred on February 22, 2011 with 185 fatalities and serious damage to buildings and urban infrastructure. The suburbs were less affected than the central city; however, liquefaction damaged the infrastructure especially in areas close to the River Avon in the eastern part of the city. The study focuses on two main research questions: how did the garden help gardeners cope with the earthquakes? And, which garden features and garden-related events helped gardeners recover from the earthquakes? The study provides garden planning and design recommendations to improve the resilience of earthquake-prone communities.

2. Methods

2.1. Case study

Following Van Wynsberghe and Khan (2007) we define case study not by method but interest in a particular case. The study is based on a single case of specific and immediate interest (Flyvbjerg, 2006; Stake, 1995, 1–13; Yin, 2014, 51–56). Resembling Yin’s “revelatory case” (2014, 52), the study does not anticipate generalisation (Stake, 2005, 443). It uses an opportunity to access a unique situation and generate relevant context-related knowledge.

The case study site is the New Brighton Community Garden (NBCG). New Brighton is a coastal suburb of Christchurch (Fig. 2), located in an area where liquefaction damage was the most severe due to the geological disposition and vicinity to the Avon River. The garden was established in 2005 after converting an outdoor bowling site for women. The garden receives annual funding from various sources including government and non-governmental organisations. Funding is partly used to finance two paid staff, a garden coordinator and an administrator. The latter also manages the funding application process that occur throughout the year due to different funding application deadlines. Community gardeners are volunteers who can visit the garden which is open four days a week without a membership. We use “visit” in a general sense regardless of the activities gardeners do while they are at the garden. NBCG comprises an area of approximately 2300 m². Most of the site is used as common space to grow vegetables and flowers; some lots are designed for individual use (Fig. 1). Gardeners can have lunch together at tables outside or inside the pavilion. A ‘Shared Lunch’ is held on the first Monday each month. There is a playground with equipment for children. The car park of the Rawhiti domain, of which NBCG is part of, is available for gardeners. At the seedling shop, seedlings grown at the garden can be bought. Seedlings are also sold on an open day, an annual public event used to sell products from the garden and enjoy entertainment, such as live music. The land is owned by the municipality (Christchurch City Council) and leased to NBCG for 15 years for an annual symbolic fee of one New Zealand Dollar. Reasons for choosing the garden as a case study include its pre-earthquake establishment, size (a larger garden), frequent visitors, dedicated social spaces, regular social activities, and a semi-professional management. In addition, gardeners and management have been open-minded and very helpful to a ‘strange’ researcher who visited regularly and spent a considerable amount of time in the garden.

2.2. Data collection and analysis

In January and February 2016, we conducted three field surveys at NBCG to inventory the features of the garden (Fig. 1). We subsequently collected quantitative and qualitative data involving 42 gardeners and two staff members.

First, a questionnaire-based survey was conducted to gather basic demographic information on gardeners including age, gender, nationality, place of residence, time of residency in Christchurch, and the year of their first visit to NBCG. Survey participants (n = 44) were predominantly female (Table 1) and New Zealand nationals (Table 2). More than half of the participants were 50 years and older (Table 1). Most participants had lived in Christchurch for more than 10 years (Table 3). Seventeen volunteers had been engaged in activities at NBCG since before the February 2011 earthquake. The majority of survey participants were from New Brighton or adjacent suburbs within a 2 km radius (Fig. 2).

We also examined the daily numbers of gardeners before and after the February 2011 earthquake based on the record kept by the garden coordinator. In addition, the monthly number of gardeners between January 17, 2011 and December 31, 2015 was assessed to grasp the long-term trend. The record showed the names of gardeners who came to the garden on a particular day; we were not able to distinguish

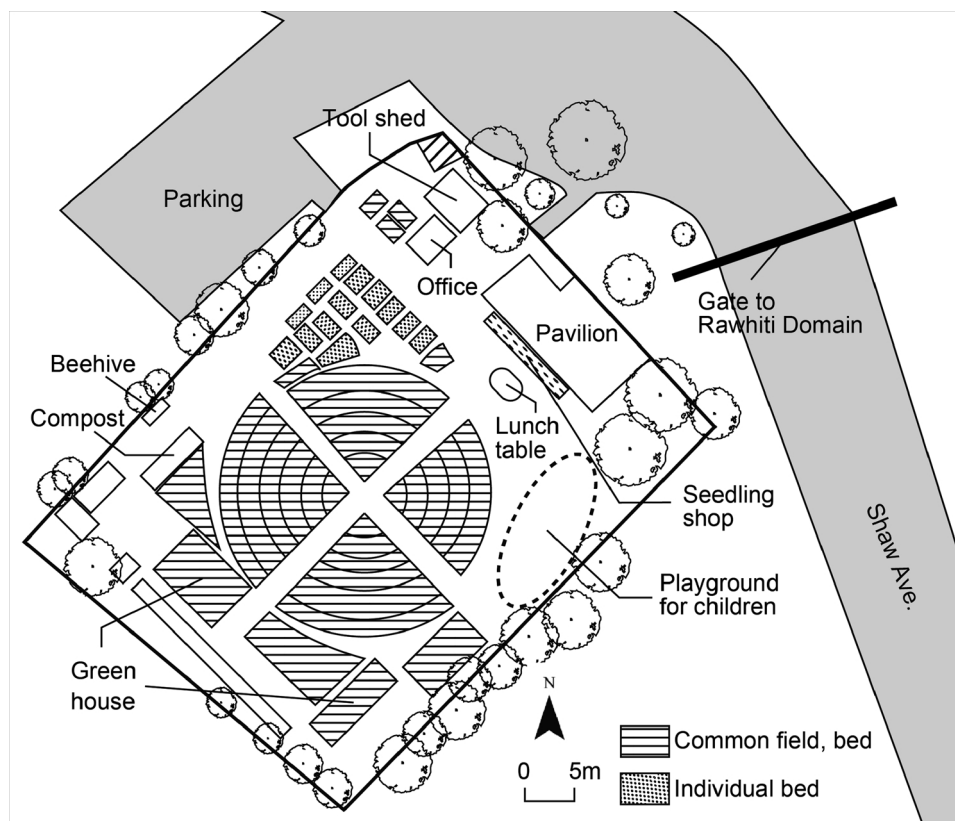


Fig. 1. New Brighton Community Garden (spatial plan; scale ca. 1:1000).

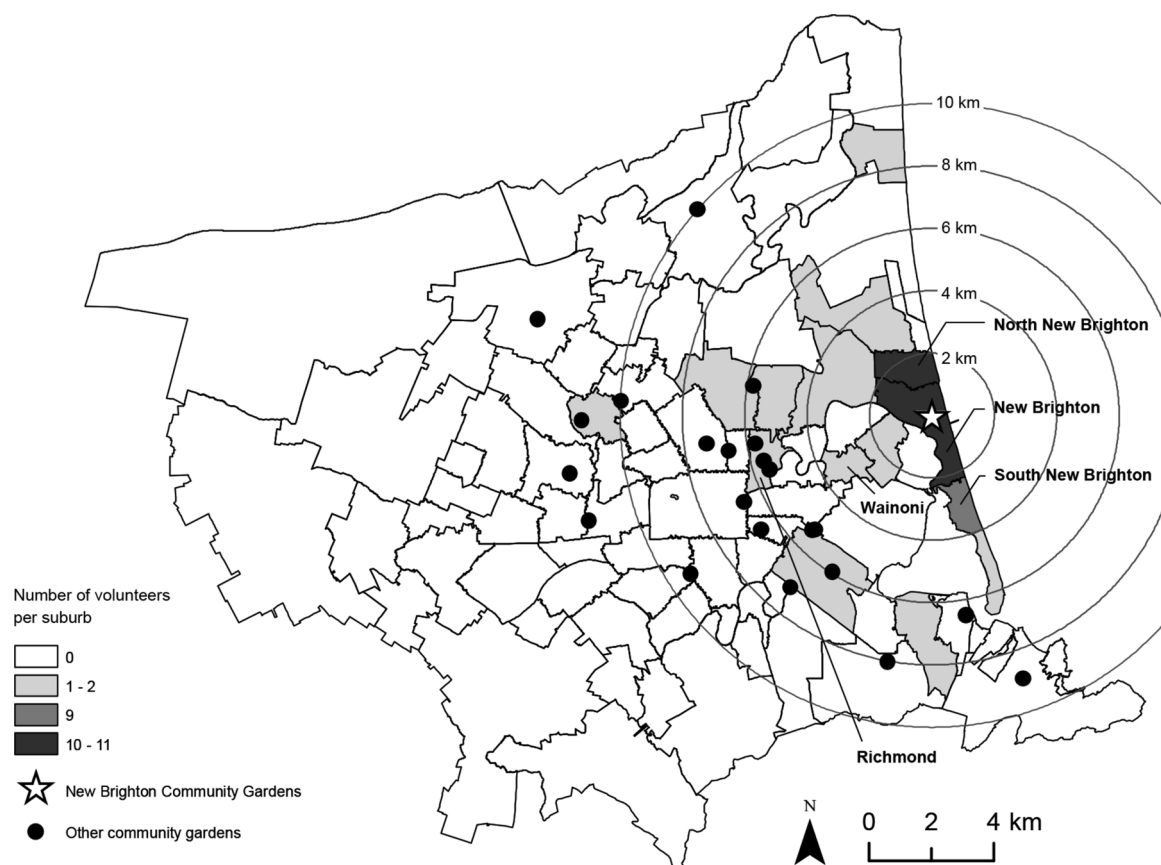


Fig. 2. Location of New Brighton Community Garden in Christchurch. The garden is attended by those living outside the community, although most volunteers live within 2–4 km of the garden.

Table 1
Age and gender of gardeners.

Age group	Gender		Total
	male	female	
0-16	0	1	1
17-29	2	4	6
30-49	3	7	10
50-65	4	9	13
66-79	5	5	10
80+	0	4	4
Total	14	30	44

Table 2
Nationality of gardeners.

Nationality	Number of gardeners
New Zealand	32
UK	6
Australia	1
Italy	1
Spain	1
Germany	1
Argentina	1
The Netherlands	1
Total	44

Table 3
Years of residency in Christchurch.

Years of residency	Number of gardeners
0 – 1 years	3
2 – 5 years	6
6 – 10 years	4
> 10 years	31
Total	44

gardeners who just dropped by from those who did ‘active’ gardening.

Lastly, we conducted qualitative in-depth interviews with a smaller sample of gardeners [$n = 8$; Table 4] to determine whether and how the garden contributed to gardeners’ recovery following the earthquakes. Based on the questionnaire-based survey, gardeners that had been working in NBCG frequently before the earthquakes were selected as one group of informants for in-depth interviews [$n = 4$]. Gardeners who started visiting NBCG frequently only after the 2010/11 earthquakes were selected as a second group of informants [$n = 4$]. They were not the only persons belonging to each group but were selected because they were available on site during the survey period and agreed to an interview. A semi-structured interview guide was prepared including questions regarding informants’ motivations, activities and feelings in three periods: a) before the earthquakes, b) right after the earthquakes and c) the present. The interviews were recorded and fully

transcribed. From our eight interviewees (Table 4), key informants 1, 4, 5 and 6 were regular NBCG gardeners before the February 2011 earthquake. Informants 2, 3, 7 and 8 joined the garden only after the earthquake. Informant 4 had to stop visiting the garden following the 2011 earthquake in order to fix his house and take care of relatives who lost their home.

Through inductive qualitative content analysis, the obtained transcripts were divided into 340 meaningful narrative segments. A segment is a sentence or a short sequence of sentences dealing with a particular topic or contextual category. Across the eight interviews, a total of 53 different contextual categories were identified. Out of these 53 categories, we extracted 24 categories related to garden activities, physical garden structures and gardeners’ feelings towards the garden to examine changes following the February 2011 earthquake. Table 5 provides information about the extracted contextual categories and the number of narrative segments for each of the 24 categories and informant (1–8). Using the narratives in the selected categories, helped us understand what happened to the gardeners and the garden following the earthquake.

3. Findings

3.1. Use of the garden following the Earthquake

The New Brighton Community Garden coordinator keeps a record of gardeners who visited and used the garden starting January 2011. This is the New Zealand summer season and gardener numbers were expectedly high; a tendency that continued until February 21, 2011 (Fig. 3) – the day before the most destructive earthquake occurred. Following the February 22 earthquake, gardener numbers dropped significantly. Less than ten gardeners visited on each working day for about one month. February and March are summer months and gardener numbers in the same period of other years (2012–2015) were significantly higher (Fig. 4). However, from May 2011 gardener numbers increased, and in July 2011 more gardeners used the garden than in any other year – even though it was the middle of winter. In comparison to July 2013, when the second highest number of gardeners was recorded, about 30 additional visits took place in July 2011. While 2011 shows a unique trend, frequencies of use appear to be similar between 2012 and 2015. This indicates that the use of the garden returned to a regular pattern after 2011. The average number of gardeners per month was 40 in 2011, 42 in 2012, 43 in 2013, 42 in 2014 and 42 in 2015. Therefore, although visiting patterns were different, the total number of gardeners did not change significantly.

3.2. Changes to garden activities and physical garden structures following the earthquake

Informant 1 said he noticed some volunteers left the garden because they were forced to move away due to earthquake damages to their homes or because the areas they lived were red-zoned. They also noted

Table 4
Interviewed key informants (in order of the interviews).

Key Informant	Nationality	Gender	Age group	Residency in Christchurch	First visit to NBCG	Home suburb
1	UK	M	66-79	> 10 years	Before earthquakes (2005)	North New Brighton
2	NZ	F	80+	> 10 years	After earthquakes*	North New Brighton
3	NZ	F	50-65	6 – 10 years	After earthquakes (2011)	South New Brighton
4	NZ	M	66-79	> 10 years	Before earthquakes (2005)	South New Brighton
5	NZ	F	50-65	> 10 years	Before earthquakes (2007)	New Brighton
6	NZ	F	66-79	> 10 years	Before earthquakes (2005)	New Brighton
7	Italy	M	30-49	6 – 10 years	After earthquakes (2015)	Richmond
8	Spain	F	30-49	Less than 1 year	After earthquakes (2015)	Wainoni

* Informant 2 answered that she visited the garden in 2008 for the first time when the questionnaire survey was conducted. However, she said in the interview that she came only after the major earthquakes in 2010/2011.

Table 5

Narrative segments per informant in the selected contextual categories (Categories directly related to the earthquake are highlighted).

Categories / Segments per informant	1	2	3	4	5	6	7	8	Total
Activities	3	4	2	0	3	4	1	1	18
Aftershocks and feelings	0	0	0	0	0	2	0	0	2
Back to the garden after the earthquake	0	0	0	2	0	2	0	0	4
Benefit of the garden	6	1	6	4	4	6	1	1	29
Change of him/herself	0	0	0	2	0	0	0	0	2
Change of the garden	4	1	3	4	1	6	0	0	19
Damage at his/her house	0	0	0	0	0	2	0	0	2
Damage at the garden	1	0	0	0	0	0	0	0	1
Damage in the neighbourhood	0	0	0	0	0	2	0	0	2
Feelings about Open Day/ Shared Lunch	2	4	2	1	2	4	2	3	20
Feelings about the garden in general	4	2	2	6	1	2	0	0	17
Feelings about the garden after the earthquake	0	0	0	0	0	1	0	0	1
Food distribution to the neighbours after the earthquake	0	0	0	0	0	7	0	0	7
Food/flower acquisition	1	2	3	3	3	1	1	2	16
Garden as evacuation place	1	0	0	0	0	1	0	0	2
How to find the garden	0	1	1	3	0	0	1	1	7
Life after the earthquake	0	5	1	1	0	0	0	0	7
Life before the earthquake	0	0	0	1	0	0	0	0	1
Motivation to come to the garden	2	10	7	6	4	5	1	2	37
Reason of leaving the garden for a while	0	0	0	1	0	0	0	0	1
Reason to come back to the garden after the earthquake	0	0	0	1	0	0	0	0	1
Sense of community	1	1	1	1	0	2	1	2	9
Visit after the earthquake	0	1	0	13	0	0	0	0	14
What happened on the day of the earthquake	0	0	0	2	0	2	0	0	4

an increase in the number of new gardeners:

“There’s that many people...it never used to be as busy so there was more to go around but now there’s more people there’s less to go around. ...

Informant 1

However, asked about changes to NBCG following the earthquakes, three of the four informants who joined at the garden before the earthquake replied that there were no significant changes in terms of the garden itself. However, there had been changes with regard to the people that came to the garden:

“Oh yes, [the garden is] much the same. In fact I can’t think of much before the earthquake, it’s like it [the garden] continued on [...]”

Informant 4

“That hasn’t changed much since before the earthquake, I work mainly on my allotment I guess but also in the communal gardens. [...] Well yes indeed, there were some people who moved away so they didn’t come in anymore, yes, you’re right and of course some people get older and not able to do it anymore but yes, definitely some people stopped because of the earthquake.”

Informant 6

Some interviewees noted that the garden suffered little damage compared with their own homes and gardens:

“[...] it (the garden) was always like that, it hasn’t changed but I know at my house trees have died because of the change in the ground and water from the estuary from the river has come into the ground and the salt water has come in and killed trees but there’s more changes at home than here, here seems to have survived very well.”

Informant 4

3.3. Gardener’s feelings towards the garden following the February 2011 earthquake

Gardeners experienced a range of motivational factors that attracted them to the garden following the Canterbury earthquakes. The main reasons to come were to socialise with others, and to enjoy gardening.

All key informants agreed that meeting people and socializing was a key motivator. In particular, retired people sought contact and conversation outside their homes:

“[...] when you retire you need to have conversation, keep your mind going otherwise you become like a vegetable and you just shrink.”

Informant 1

“I needed to meet people and have something to do because in a unit (they’re little), and you can’t sit around and do nothing and I enjoy being able to take vegetables home and I love the company and it’s good.”

Informant 2

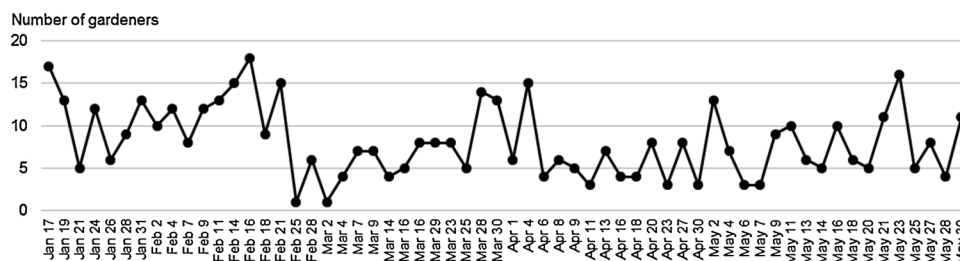


Fig. 3. Number of gardeners per day in early 2011.

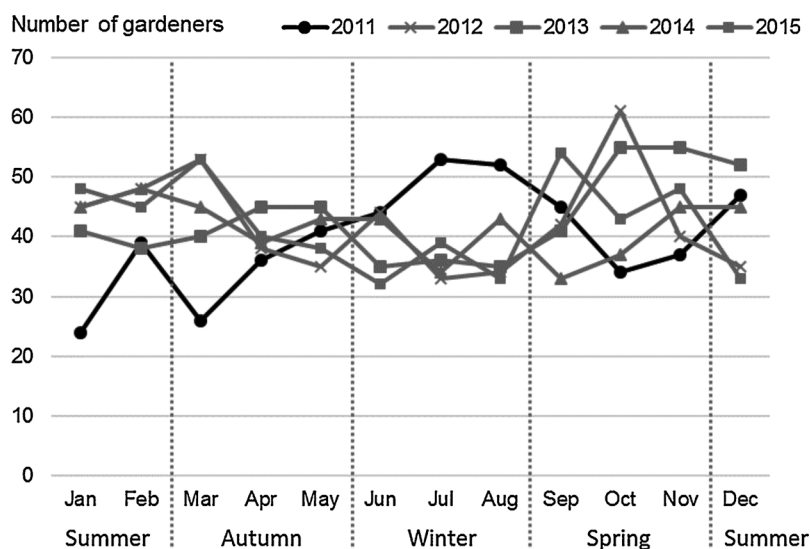


Fig. 4. Number of gardeners per month, 2011–2015.

Two retired interviewees perceived the garden as an opportunity to do something with their daily lives. Half of the interviewees stated that the joy of gardening motivated them to visit NBCG. One key informant enjoyed being outside, feeling healthy and working toward the betterment of his community. He experienced serious earthquake damage to his house, and for him, the garden became a place relax and escape his troubles:

“Keeps me busy, keeps the mind going, keeps you active, keeps you fit, it does benefits for everyone so that’s why I like it. [...] and I still enjoy the company and the people here and the chance to be outside, get some fresh air, get away from home. [...] I’m going to the gardens and relax.”

Informant 4

Three other informants also stated that they visited the garden because they felt they were needed or they wanted to help someone. Several informants mentioned that receiving fresh fruits and vegetables for free was a key motivator:

“Yeah that’s one of the good things for me is that with my two volunteer jobs I have they both involve getting free fruit and vegetables for helping out and so I don’t now have to go and buy them, so it takes that off my grocery bill which makes living a lot easier for me. I save about \$20 a week on my grocery bill so I was really struggling before I started coming here.”

Informant 5

When asked about the benefits of visiting NBCG, the majority of informants considered joining a community and meeting diverse people including overseas gardeners as relevant factors:

“I’ve met Australians, Brazilians, I’ve got a friend who comes in and he’s Australian. There’s a Spanish girl comes here, there’s about five... oh I suppose maybe over the years probably a dozen different nationalities have been here, well like yourself, Japanese, Dutch, occasional German, odd French person so that’s normally summer time when they’re on holiday or they’re students and not at university and come and wander around so you meet different people.”

Informant 1

“Always like to talk to people, there’s a very different, very broad cross section in the community here, different people of different backgrounds and I like the sort of work they do here with people which are maybe handicapped or have some sort of difficulty.”

Informant 4

Informant 7 and 8 are overseas gardeners, who joined the garden in 2015, four years after the major earthquakes. They both mentioned interest in gardening and meeting people as main motivations to join the garden.

“I was curious about this place, I had friends living here and that’s why I came to Christchurch, to start a new adventure and that’s the same with gardening because I like to meet new people and I like to kind of take a bit of control about the food we eat and to know how to grow food, I think that’s a very political act to do is to take control of what we eat.”

Informant 7

“I came here because I was looking for a place to get my hands dirty and to meet new people, likeminded people with the same things that I like which is to be outside and doing some work outside with plants, veges. ...”

Informant 8

They chose NBCG because it was the only community garden which opened on weekends. They both work full-time on weekdays, so they could not join other gardens. This is the reason why they came from suburbs relatively far away from NBCG. (Fig. 2 & Table 4)

“[...] I do work in construction [...] Well I came here for the first time actually only because this was the only garden I could find that was open on a Saturday because having a full time job I couldn’t go to any.... because all the other gardens, community gardens I found in Christchurch they had working bees during the week days so I couldn’t attend so I found on the internet that this was open on a Saturday so that suited me pretty good so that’s why I came here the first time.”

Informant 7

“[...] that’s why we came here, to help with the rebuild after the earthquake. [...] I have a full-time job, I’m doing health and safety and I’m the health and safety administrator for [xxx] here in Christchurch. [...] I came in February and around March I was exploring New Brighton and I went to the library and I saw the pamphlet with these community garden advertising that they were working Monday, Wednesday, Friday and Saturdays and I say oh yeah, I didn’t have a job for that time so I said yeah, let’s go there and meet new people and do something for the community as well. [...] I’ve been coming here every Saturday for a full year, it’s part of my life already. [...] they [this community] make me feel I am part of this place already even if I am foreign, they make me feel very comfortable and is like my family, my Saturday family.”

Informant 8

The garden was regarded as a place to relieve stress, for example by communicating with others or sharing stressful experiences:

“[...] people chat, chat, chat and oh it's terrible but they were talking about it and that takes a lot of pressure off and oh, I feel better. Yeah it helps because you come and talk to somebody and if you've been in a crash and I've been in a crash, we have something in common, we can both talk about our experience, so you listen and then you talk so conversation.”

Informant 1

Other perceived benefits included the availability of healthy food, improving the environment and transmitting useful knowledge about gardening. Focusing on the immediate emergency period following the February 2011 earthquake, informants' accounts reveal that the garden did not serve as an evacuation space. There were no apparent problems to obtain food and many supermarkets stayed open. However, it was harvest season and less gardeners came to the garden to pick up vegetables. Therefore, one informant distributed vegetables for free at the gate of the garden and in the neighbourhood:

“(Question: So what did you do in this garden when you came here just after the earthquake?) Probably just checking, that was February so there would have been vegetables to harvest, we probably harvested vegetables and probably at that time because there weren't so many volunteers coming we probably put vegetables at the gate for people to take, we do that when there's too many like cucumbers and zucchini and things like that. We put them at the gate and say “free” for anyone to take. [...] No, I think the supermarkets stayed open, I think it did. [...] we don't like wasting things so we were glad [...] to give them to somebody who would use them.”

Informant 6

NBCG would have been able to supply gardeners with water and electricity; however, the garden was not used as such even although there were residents who had difficulties in obtaining water and electricity supplies:

“I'm amazed at that because at that time we had no water, no electricity or anything at our homes. No, I don't think we had to, I'm trying to think. [...] We couldn't charge cell phones of course but no, at that time we talked about getting a generator for the gardens for that sort of thing but nothing ever came of that – to create our own electricity but we didn't do anything about it.”

Informant 6

4. Discussion

The garden contributes to local community life by providing a safe place for social interaction and physical activities. Those social functions of the garden increased following the earthquakes. The majority of gardeners who obtained such social benefits from the garden in the aftermath of the earthquakes were local residents 50 years and older.

Although gardeners did not visit the garden as often as usual for about two months following the February 2011 earthquake, they came back. The peak of visits appeared in July 2011, five months after the February earthquake in full winter. There are no other apparent explanations for this surge of garden visits. It appears to be phenomenon associated with post-disaster periods. Solnit (2009) pointed out that ‘paradises’ emerged after major disasters when people seek social interaction and try to help each other in otherwise chaotic and highly stressful situations. The high frequency of use of NBCG in July 2011 could be regarded as such a phenomenon. The garden experienced a slight decline of visits in the later part of 2011. However, gardener frequencies returned to a stable pattern in 2012 and remained strong in the following years. The fact that NBCG had been a well-established

community garden before the earthquakes with a steady management system and regular volunteers might have contributed to this process. Gardeners at NBCG are predominantly long-term residents who had resided in the neighbourhood for more than 10 years. In contrast, another community garden in Christchurch, established post-earthquake in the city centre on Fitzgerald Avenue was very popular in the immediate post-disaster period, but lost its most gardeners by 2015 (Montgomery et al., 2016). Findings, based on single cases, are not representative. Any attempt to generalise our data beyond the case, are speculative and additional (comparative) studies are needed to substantiate findings. However, based on those preliminary findings, the paper suggests that both pre- and (temporary) post-disaster community gardens may play important roles in the immediate disaster recovery period following the earthquakes. In addition, gardens that have been well established and frequented before a disaster may provide continuous long-term benefits that extend past the immediate disaster recovery period. Long lasting mental health issues, in particular, are common among those who have experienced a disaster (Spittlehouse et al., 2014) and community gardens may be beneficial in helping to relieve traumatic stress. Planning of such gardens could be improved by increased public administrative and financial support to ensure stable self-management and community backing on a long-term basis.

Informants liked to meet people at the garden and conversations helped them to overcome hardship following the disaster. Many people in the New Brighton had to face a reality where their city had become severely damaged and people killed; re-build efforts consumed their energy and time and proceeded slowly due to insurance issues. In the Canterbury Region including Christchurch, 90 percent of the overall earthquake damage is covered by insurance and the diversity of insurance contracts is one of the reasons for the slow rate of the reconstruction (Howden-Chapman et al., 2014). The garden did not significantly change after the earthquakes; rather, coming to the garden after the event helped gardeners relax and relieve stress. These are important factors that help to provide a sense of normality in an otherwise chaotic situation. Previous research suggests that urban gardening provides a stress-relieving refuge, contributes to a healthier lifestyle, creates social opportunities, provides valued contact with nature, and enables self-development (Genter et al., 2015). The number of segments in the categories directly related to the earthquake is limited (Table 5). A possible reason why informants did not mention the earthquakes in relation to the garden more frequently could be that half of the informants joined the garden only after the earthquakes. Therefore, they were not able to answer what happened in the garden around the time of the disaster. Another possible reason could be that five years had passed since the earthquakes when we conducted the survey. Nonetheless, the limited number of obtained segments relevant to the earthquake are relevant and clearly state the role NBCG played after the earthquakes. Thus, the results of our study confirm some of the discussed benefits; particularly, the social benefits seem to be even more important in a post-disaster situation.

In New Brighton, we also encountered gardeners from overseas who had not been part of the community before the earthquakes (Table 2). Christchurch has seen increased immigration from overseas following the earthquakes “which can largely be attributed to the Christchurch rebuild and the requirement for skilled workers to assist with the rebuild, particularly workers in construction, engineering and trades” (CCC, 2018). Often, immigrant workers are engaged in construction work and therefore essential for disaster recovery like our informants 7 and 8. Community gardens are places that provide opportunities for exchange between long-term locals and new migrants. NBCG has accommodated not only the needs of local, and often elderly people, but also of younger gardeners from overseas. The diversity of people has been highlighted as a positive characteristic of the garden.

Spatial design and community activities within the garden that support social capital construction are also important for strengthening the resilience communities – before and after an earthquake. NBCG

provides a number of beneficial design features such as common vegetable fields that occupy a large area and support gardener socializing while weeding, watering and harvesting. The pavilion and lunch tables play a similar role, encouraging communication and sharing. With regard to social activities, the garden coordinator plays a key stimulating role. She encourages shared gardening activities calls for shared mealtimes, organizes social events, such as the open day, and makes everyone, including new gardeners, feel welcome. Receiving a warm welcome upon arrival may be a factor in gardener retention.

Research by Tahara et al. (2011) shows the potential of community gardens for food supplies. The New Brighton garden did not have a relevant food supply function following the disaster; however, the fact that gardeners provided free vegetables to neighbours confirms a social phenomenon where people share resources with each other following disasters. In addition, informants talked about the general importance of receiving fresh produce from the garden. Community gardens could be designed to feed people for several days following an earthquake until relief supplies can be secured.

Green open spaces are less prone to infrastructural damage than buildings. Although NBCG was not used as an emergency evacuation point, facilities such as the power generator could have been used. Likewise, stored rain water could be used in case of infrastructural damage and related water shortages. However, one informant reported that she simply did not think of using the garden's power generator although she had no electricity at home. Therefore, it is not only important to equip a garden with facilities useful in an emergency, but also to keep everybody informed about them.

5. Conclusions

Community gardens can contribute to spatial planning and design strategies seeking to increase community resilience following earthquakes and are particularly valuable in earthquake-vulnerable areas within cities. Well-established community gardens may help secure food supplies and provide essential infrastructural support following a disaster. However, first and foremost, community gardens help strengthen social interactions, relieve stress and build the social capital that is needed when a disaster strikes. Therefore, planning and establishing community gardens prior to a disaster would help increase community resilience in the event of a significant earthquake. Gardens should be designed with features that encourage social interaction and group gardening activities to enhance feelings of control and normality and reduce stress. They should be managed to support appropriate community-building activities and events.

Frequent barriers with regard to the governance of community gardens are land tenure insecurities and insufficient funding (Fox-Kämper et al., 2018). The practice of community gardening is sometimes understood as a temporary practice on temporarily-available land; however, the temporary use of vacant land is not necessarily the purpose of establishing a community garden (Drake and Lawson, 2014). If we aim at reducing disaster risks, community gardens might be considered as long-term assets that require long-term tenure security, safeguarded by urban planning policies.

Community gardening is mostly based on voluntary action by local residents, while the New Brighton case shows that a dedicated paid (part-time) coordinator has been vital for the success of the garden. Additional paid activities such as accounting or organic waste collection (Shimp et al., 2014) might be beneficial as well. Our single case study can only provide exemplary evidence. Further comparative studies and findings from other gardening projects are needed to collect more conclusive data, for example on an adequate balance of voluntarism and professional management and its influence on the success and the longevity of a garden. It may, however, be safe to say that making sufficient (public) funding available for establishing and managing community gardens before a disaster strikes will likely strengthen the beneficial long-term role of urban community gardens

following a disaster.

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